

Evaluation of a Low-Cost Salmon Production Facility

Annual Report FY 1986

by

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ABSTRACT

Fiscal year 1986 was the fourth year of a study sponsored by the Bonneville Power Administration (BPA) to evaluate the presently existing, low-cost salmon production facility operated and maintained by the Clatsop Economic Development Committee's (CEDC) Fisheries Project through program measure 704(j)(1) of the Power Planning Council's Fish and Wildlife program.

Activities during the study focused on accomplishment of the following objectives: (1) Investigate the potential for community involvement, (2) evaluate natural outmigration of smolts, (3) provide cumulative production of large numbers of quality salmon while maintaining genetic variability, (4) aid in development of optimum density levels in earthen ponds, and (5) augment a unique "known stock" fishery.

The local community contributed over \$62,000 to the Clatsop Economic Development Committee Fisheries Project in 1986. That amounted to about 30% of the overall budget.

Smolt migration from the earthen rearing ponds was accomplished volitionally. The larger smolts (13 fish/pound) left the ponds more readily, and also contributed to the various fisheries at a higher percentage than did smaller smolts (15 fish/pound).

In 1986, the CEDC Fisheries Project reared and released a total of 3.7 million salmon. Approximately 400,000 of the total were coho, 3 million were lower Columbia stock chinook, and 250,000 were Rogue River stock fall chinook.

Pond loading densities were increased for the coho production in 1986 as compared to 1985. Pounds of fish/gallon/minute at release was increased from 16.6 to 18.7 in one rearing pond, and from 12.5 to 21 respectively, in the other pond. The fish reared at the 18.7 lbs/gal/min level experienced mortality, whereas the others showed no signs of stress. This pond had a faster turnover rate of water through the pond to possibly allow for the higher density in relation to flow.

Fish reared and released by the CEDC Fisheries Project contributed to the various fisheries from California to Alaska. The primary beneficiary was the Youngs Bay gillnet fishery, where the largest percentage of returning adults was harvested. In 1986 approximately 75% of adult salmon returning to Youngs Bay were harvested.

INTRODUCTION

In 1983 the Bonneville Power Administration (BPA) began funding a project with the Clatsop Economic Development Committee's (CEDC) Fisheries Project that addresses program measure 704(j)(1) of the Power Planning Council's Fish and Wildlife Program. This measure directs emphasis on developing and testing small-scale, low-cost, salmon and steelhead propagation facilities adaptable to Columbia basin locales. The CEDC Fisheries Project is an existing low-cost facility that is being evaluated with respect to the feasibility of implementing similar programs in other locales. Interrelated measure 704(h)(5), regarding the smolt survival index, is being addressed through the evaluation of CEDC's smolt release strategies.

The CEDC Fisheries Project continues to operate and maintain three earthen, gravity flow rearing ponds on the Youngs Bay drainage in Clatsop County, Oregon, Hickerson and Hill (personal communication, 1984). Annual production continues at approximate levels of 3,000,000 lower Columbia fall chinook, 300,000 coho, and fluctuating releases of chum salmon. Also, the recently introduced Rogue River fall chinook stock has been reared at levels ranging from 20,000 to 250,000, with steady annual increases anticipated. All fish are released into Youngs Bay for subsequent return of adults to the local gillnet fishery and thereby provide the anticipated stimulus to the local economy.

The objectives of the study are to:

1. Investigate the potential for community involvement
2. Evaluate natural outmigration of smolts from earthen rearing ponds
3. Provide cumulative Production of large numbers of quality salmon while maintaining genetic variability
4. Aid in development of optimum density levels in earthen pondenvironments
5. Augment a unique 'known stock' fishery

The overall goal implemented to aid in the evaluation of a small-scale, low-cost salmon production facility was a coded-wire tagging program. For at least three consecutive years, a portion of all CEDC's releases were identified with an adipose fin clip and a coded-wire tag. This goal, upon recovery of adults, will allow the determination of CEDC contributions to various fisheries, and hence, demonstrate the feasibility of further implementation of such production facilities. The goal to achieve objective #1 is to document all of the aspects of community involvement through construction phases and annual operation and maintenance. Objective #2 addresses the natural outmigration of smolts and will be investigated through documentation of smolt release strategies and

monitoring of downstream, post-release migration. The provisions of objective #3 will be accomplished through the continual production of fall chinook and coho salmon. Egg source will be from the total run, and selection for certain individuals during spawning will not purposefully occur. Objective #4 will be addressed through the documentation of biological parameters and the effects on these through increases or decreases in production levels. The augmentation of the Youngs Bay 'known stock' fishery, objective #5, will occur through annual smolt releases and through CEDC's continual striving for production increases.

METHODS AND MATERIALS

Community Involvement (Construction)

The construction of the existing rearing ponds was documented in the 1984 annual report, Hickerson and Hill (personal communication, 1984). In 1985 there were no construction activities. In 1986 the CEDC Fisheries Project was awarded a \$92,000 grant from the Federal Economic Development Administration (EDA) for the construction of a hatchery/storage building, the installation of a small hydroelectric system, and for various research equipment and supplies. The total project cost is \$115,000 with \$23,000 matched by local funds, some of which are through construction assistance.

Community Involvement (Operation and Maintenance)

Community involvement in general operation and maintenance activities is documented in Table 1 and Figure 1. Involvement is categorized by cash and labor/materials contributions.

Natural Outmigration of Smolts

CEDC utilizes the volitional smolt release strategy where the retaining screens are removed and the pond level maintained at near full capacity. The downstream migration of smolts is monitored and correlated to the documented biological parameters such as flow, fish size at release, etc. In 1986 the retaining screens were removed on April 1 and fish allowed to volitionally outmigrate. Size at release was 12.5 fish/pound at both coho rearing ponds. Post-release seining activities were conducted in the estuary approximately two miles below the rearing sites. Full pond levels were maintained for two weeks and then slowly drained over a one-week period. Over the three-week period all fish had been released from the ponds.

Over the last three years Fisheries Project personnel have been evaluating the size at release for the annual coho production. With the two coho rearing ponds in very close proximity to each other, this offered an opportunity to compare releases from the two ponds.

Table 1. Community Contributions to CEDC Fisheries Project, 1986

Contributor	Contribution	In-Kind	Cash
AMCCO	Metal Supports and labor	\$58.35	
Big Creek Hatchery	Technical Support	\$120.00	
Bioproducts, Inc.	Feed Price Discounts	\$640.00	
Bornstein Seafoods	Poundage Assessment Match		\$10,013.37
Cavenham Forest Industries, Inc.	Six Piling	\$500.00	
Clatsop County	Payroll/Admin./Legal	\$1,104.40	
Crown Zellerbach	Land Lease	\$112.50	
Fishhawk Fisheries	Poundage Assessment Match		\$954.94
Duane Jue	Truck Rental	\$100.00	
Stan Kahn	Nets	\$100.00	
Klaskanine River Hatchery	Tech. Support/Freezer Space	\$1,450.02	
Knappton Corporation	Eight Piling	\$500.00	
Eldon Korpela	Towing Expense	\$250.00	
Ivan Larsen	Towing Expense	\$150.00	
Ocean Foods of Astoria	Poundage Assessment Match		\$161.82
ODFW	Technical Assistance	\$249.96	
OSU Extension(J. Bergeron)	Technical Support	\$187.47	
OSU Seafoods Laboratory	Office/Lab Equipment and Office/Lab/Freezer Space	\$7,590.00	
Otter Trawl Commission	Xerox Copier Use/Supplies	\$350.04	
Pacific Power & Light	Scrap Bolts	\$150.00	
Point Adams Packing Co.	Poundage Assessment Match		\$9,825.83
Point Adams Packing Co.	Cash Contribution		\$584.00
Port of Astoria	Mooring Floats; Lumber; Misc. Hardware	\$1,800.00	
Port of Astoria	Heavy Equipment - Dirt Work	\$3,600.00	
Joan Pratt	Accounting Counsel	\$40.00	
R. William Tynkila	Mink Cages	\$100.00	
Vanderveldt Family	Land Lease	\$200.00	
Western Fab - Richard North	Welder Rental	\$100.00	
Yongs Bay Fishermen	Poundage Assessment		\$21,621.75
	Subtotal	\$19,452.74	\$43,161.71
	TOTAL		\$62,614.45

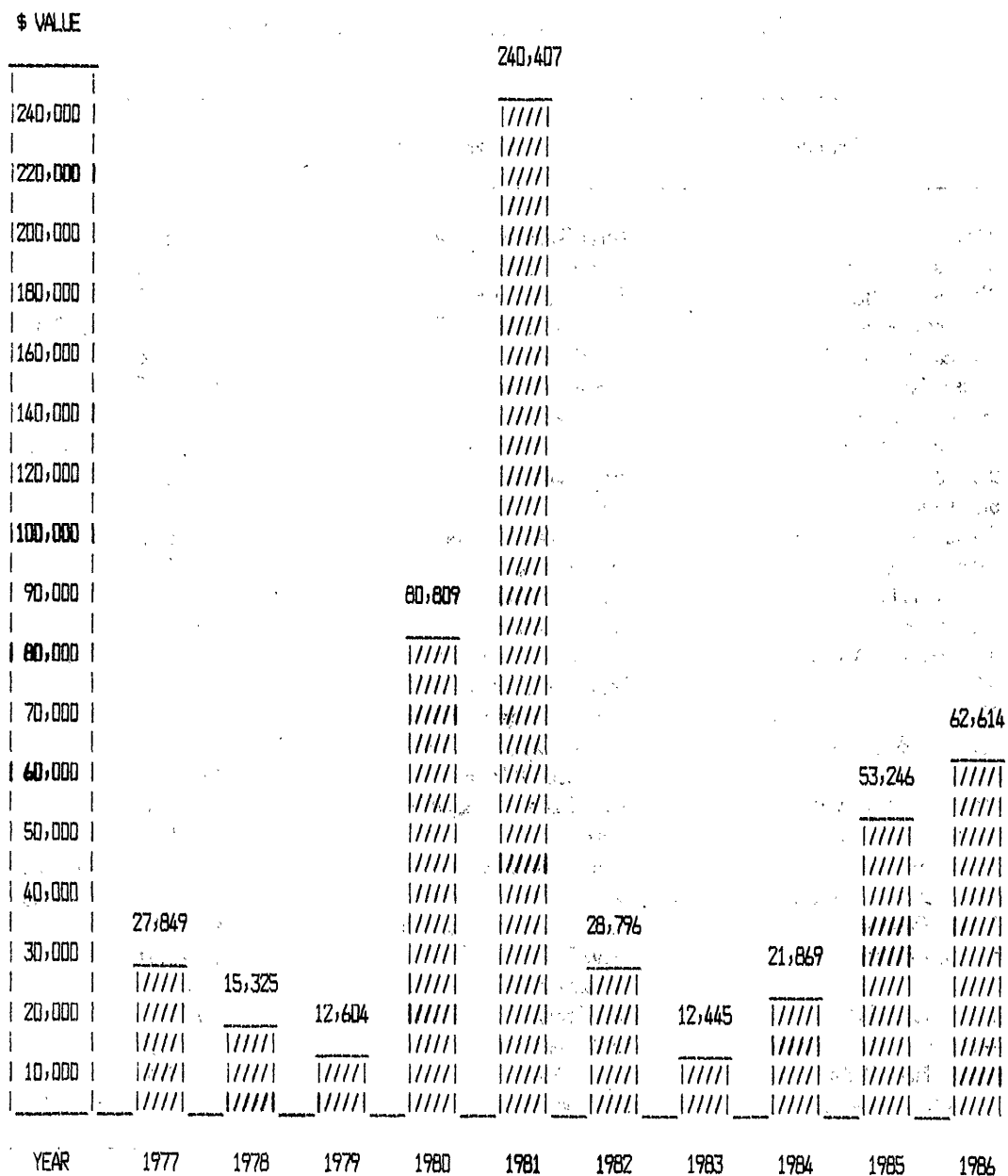


Figure 1. Annual Community Contributions to CEDC Fisheries Project

Average smolt size at release was different at each pond in 1984 and 1985, and in 1986 the smolt size in each pond was the same.

In 1986 a small scale project was initiated to determine if the period during which the tules were migrating from the release site to the lower estuary had an impact on subsequent survival levels. The assumption was made that during this time period the predator mortality to juveniles is significant. To prove this assumption, a group of 25,000 smolts were coded-wire tagged and transported by truck to lower Youngs Bay. The returns of this group will be compared to the coded-wire tag returns of fish released from the rearing site. Comparative releases will continue for several brood years.

Cumulative Production of Quality Salmon

The CEDC Fisheries Project continues annual releases of coho and chinook salmon. Occasionally other species such as chum salmon are released (Table 2). The Project receives eggs and/or fry from nearby hatcheries operated by the Oregon Department of Fish and Wildlife (ODFW). The Youngs Bay gillnet fishery, with a harvest of about 85% of the returning fish, does not allow adequate escapement and subsequent egg take to fulfill annual production goals. CEDC personnel spawn the few adults that escape the fishery and enter the trapping facilities.

Development of Optimum Density Levels

Pond volumes were determined by CEDC personnel using flow rate and time taken to fill each pond. To help check the accuracy of these volumes CEDC solicited the help of the Clatsop County surveyor and compared his results with the flow-determined results at the South Fork Klaskanine pond #3. With CEDC assistance, several cross sections of the pond were determined as well as the overall volume.

In 1986 the coho production was increased at the Vanderveldt ponds in an effort to determine maximum production levels without supplemental oxygenation. Production was increased in pond #1 from 98,543 fish in 1985 to 140,651 fish in 1986. In pond #2 the increase was from 203,683 fish in 1985 to 263,126 fish in 1986. Of the pond #2 production, 14,401 fish were an experimental group of triploid coho. Fish were released at 12.5 fish/pound at both ponds.

Augment a Unique Known Stock Fishery

Contribution analysis of CEDC released fish to the various fisheries stems from the capture of previously coded-wire tagged fish. The analysis requires cooperation of all agencies from California to Alaska for retrieval of the CWT information. Gathering and processing this information takes time that generally extends beyond the various fishery closures. For 1986 the large harvest level creates an even longer information recovery period, hence, the 1986 information in this report does not include all final numbers (Tables 3, 4, and 5).

Table 2. Summary of 1981 - 86 Releases from CEDC Fisheries Project Facilities

Date	Tag Code	Release Site	Species	Release Numbers		% Tagged
				Total	# Tagged	
4/9/81	---	#1	chum	520,000	---	---
5/15/81	7-21/58	#3	CHF	1,800,915	73,242	4.06
5/22/81	7-21/59	#1 & #2 a	CHF	1,357,693	48,898	3.60
4/1/82	7-21/44	#1 & #2 a	coho	300,000	53,000	17.67
5/28/82	7-24/12 b	#3	CHF	1,918,862	79,695	4.15
5/28/82	7-24/13 b	#3	CHF	822,366	33,857	4.12
4/5/83	---	#1	coho	98,278	---	---
4/5/83	7-24/51	#2	coho	216,490	27,404	12.66
5/15/83	7-28/35	#3	CHF	2,480,354	105,139	4.24
8/4/83	7-28/57	#3	RCHF c	32,095	28,758	89.60
8/4/83	7-28/58	#3	RCHF c	18,053	16,176	89.60
4/13/84	7-31/41	#1	coho	93,431	26,817	28.70
4/13/84	7-31/42	#2	coho	207,943	26,697	12.84
5/15/84	7-31/43	#3	CHF	2,867,077	106,911	3.73
6/22/84	---	Youngs Bay	chum	10,000	---	---
8/24/84	LV clip	#3	RCHF c	12,638	---	---
4/1-30/85	7-33/44	#1	coho	98,543	25,574	25.95
4/1-6/85	7-33/43	#2	coho	203,683	24,690	12.12
5/20-6/1/85	7-33/45	#3	CHF	2,994,772	101,415	3.39
5/6/85	---	#2	chum	953,420	---	---
8/1-2/85	7-32/34	#3	RCHF c	10,751	10,568	98.30
"	7-32/35	"	"	10,208	10,034	"
"	7-32/36	"	"	10,431	10,254	"
"	7-32/37	"	"	9,221	9,064	"
"	7-32/38	"	"	10,189	10,016	"
"	LV clip	"	"	31,057	---	---
4/1-15/86	7-38/50 d	#1	coho	47,338	9,304	19.70
"	7-38/51 d	"	"	46,913	9,220	"
"	7-38/52 d	"	"	46,400	9,119	"
"	7-38/47 d	#2	"	86,550	10,845	12.50
"	7-38/48 d	"	"	77,725	9,744	"
"	7-38/49 d	"	"	84,450	10,593	"
"	7-38/43 d	"	" e	4,775	4,775	100.00
"	7-38/44 d	"	" e	5,013	5,013	"
"	7-38/45 d	"	" e	4,613	4,613	"
5/5-30/86	7-29/32 d	#3	CHF	984,445	24,479	2.50
"	7-29/33 d	"	"	990,374	24,574	"
"	7-29/34 d	"	"	1,008,315	25,052	"
5/12/86	7-29/35 d	#3 f	"	26,442	24,938	94.30
7/20/86	7-29/36	#3	RCHF	208,705	24,955	12.00
"	7-38/46	"	"	42,735	5,114	12.00

a Fish reared in both ponds but tagged with same code

b Two tag codes for same group

c Experimental release of Rogue River fall chinook

d Replicate tagging

e Triploid

f Transferred by truck for release in Youngs Bay

Table 3. Harvest and Survival Summary of CEDC Released Tule Chinook: 1980 - 1983 Broods

BROOD YEAR	1980		1981		1982		1983	
	NUMBER OF FISH							
YEAR OF CATCH	1983	1984	1984	1985	1985	1986 *	1986 *	1987
BC NJ Troll				240	0	100	227	
BC SW Troll				288	258	225	511	
BC Johnson St. Net					47			
WA Troll					165			
WA Sport					94			
OR Troll	80	53	72		0		54	
OR Sport					0		0	
YOUNGS BAY Gillnet	734	604	216	289	282	189	214	
Columbia River Gillnet	293	187				540	483	
OR Buoy 10 - Sport					0			
CA Troll					0			
CA Sport					94			
Hatchery Returns			48			1	1	
TOTAL	1,107	844	336	817	940			
BROOD SURVIVAL PERCENTAGE	.05	.03	.01	.03	.03			
BROOD SURVIVAL BY ALL AGE CLASSES =	.06		.04					

* Preliminary

Table 4. Harvest and Survival Summary of CEDC/ODFW Released Rogue Stock Chinook: 1982 and 1983 Broods

BROOD YEAR	1982		1983 *		1984		1985	
	NUMBER OF FISH							
YEAR OF CATCH	1985	1986 **	1986	1987	1987	1988	1988	1989
BC NW Trall		8						
BC SW Trall	33	47						
BC Johnson St. Net	2	0						
WA Trall	20							
WA Sport	95							
OR Trall	1,330	283						
OR Sport	153	12						
YOUNGS BAY Gillnet	838	233						
Columbia River Gillnet		149						
OR Buoy 10 - Sport	22	25						
CA Trall	135	159						
CA Sport	51	7						
Hatchery Returns	50	23						
TOTAL	2,729							
BROOD SURVIVAL PERCENTAGE	3.0							
BROOD SURVIVAL BY ALL AGE CLASSES =								

* This group was marked with LV clip only; no CWT

** Preliminary

Table 5. Harvest and Survival Summary of CEDC Released Coho Adults; 1980 - 1983 Broods

BROOD YEAR	1980	1981	1982	1983
		NUMBER OF FISH		
YEAR OF CATCH	1983 *	1984	1985	1986
BC NW Trawl			0	0
BC SW Trawl		126	19	215
BC Johnson St. Net		71	4	0
WA Trawl				
WA Sport		95	311	
OR Trawl	1,663	24	311	960
OR Sport	974	924	726	694
YOUNGS BAY Gillnet	655	3,002	3,118	2,181
Columbia River Gillnet		2,015	707	2,777
OR Buoy 10 - Sport		972	162	250
CA Trawl	291	766	28	207
CA Sport	129	355	18	41
Hatchery Returns		118	21	347
TOTAL		8,468	5,425	7,672
BROOD SURVIVAL PERCENTAGE		2.69	1.8	2.54
BROOD SURVIVAL BY ALL AGE CLASSES =		2.69	1.8	2.54

* Complete Information Unavailable.

For the Youngs Bay area, fish are sampled at the processing plants and at the hatchery return traps (Table 6), and are also examined during spawning ground surveys (Table 7).

Sampling rates at the processing plants for the Youngs Bay gillnet fishery were 20.4% for coho and 25% for chinook. The expansion formula utilized the mark release rate instead of the mark return rate. Because of the intense fishery and low flows during adult returns, not enough fish return to facility traps to get a statistically valid mark return rate.

Spawning ground surveys were conducted once each week for three consecutive weeks during fall chinook spawning in September and October. Dead fish were examined for marks and snouts removed from coded-wire tagged fish. All dead fish examined received a caudal severing so they would not be counted on subsequent surveys. By the end of the three-week period, nearly all fish had spawned and died.

RESULTS AND DISCUSSION

Community Involvement (Construction)

The 1986 major construction activity provided the CEDC Fisheries Project with a 30' X 100' all steel hatchery/storage building. During the actual construction phases of the project the Port of Astoria contributed about \$3,600 worth of heavy equipment time and personnel labor. The Port of Astoria activity provided a portion of the local matching funds as required by the EDA grant guidelines. The overall project of \$115,000 will be funded 80% through the EDA grant, and the remaining \$23,000 will be matched by local cash or in-kind contributions. Upon project completion, which will entail the construction of the hatchery/storage building, a small hydrosystem installation, and acquisition of various research equipment and supplies; \$92,000 will be provided by EDA, approximately \$18,000 will be provided by local cash, and about \$5,000 will be provided by in-kind contributions. Project completion is scheduled for the summer of 1987. Additional in-kind assistance is anticipated during installation of the small hydroelectric system.

Community Involvement (Operation and Maintenance)

The local community continues to be a major provider of cash, services, and in-kind contributions. Again as in 1985, these contributions (Table 1) amount to about 30% of the total Project budget. Annual contributions vary from year to year (Figure 1) and may be explained by different needs of the Fisheries Project and by fluctuations in economic situations. For example, in 1981 the Project had a large construction project and the community responded with assistance. In 1983 there was no construction activity, and the El

Table 6. Chinook and Coho Returns to CEDC Traps - 1985, 1986

Species	Trap Site	Sex	Number Trapped	
			1985	1986
Tule FCH	South Fork	M	9	1
		F	1	1
		J	2	9
Rogue FCH	South Fork	M	28	7
		F	22	16
		J	2	32
Coho	Pond #2	M	8	169
		F	12	111
		J	71	60
	Pond f/1	M		41
		F		26
		J		13

Table 7. Stream Survey Data for Tule and Rogue Stock Fall Chinook
1983 - 1986

Species	Stream	Number of Fish			
		1983	1984	1985	1986
Tule	SF Klaskanine	18	67	22	93
	NF Klaskanine	35	17	1	3
	Youngs River	0	9	1	14
	Lewis & Clark	256	194	63	104
	Tucker Creek	0	0	0	0
	Walluski	0	0	2	0
Rogue	SF Klaskanine	0	0	9	14

Nino effect on fishing conditions reflects the poor support through voluntary assessment dollars.

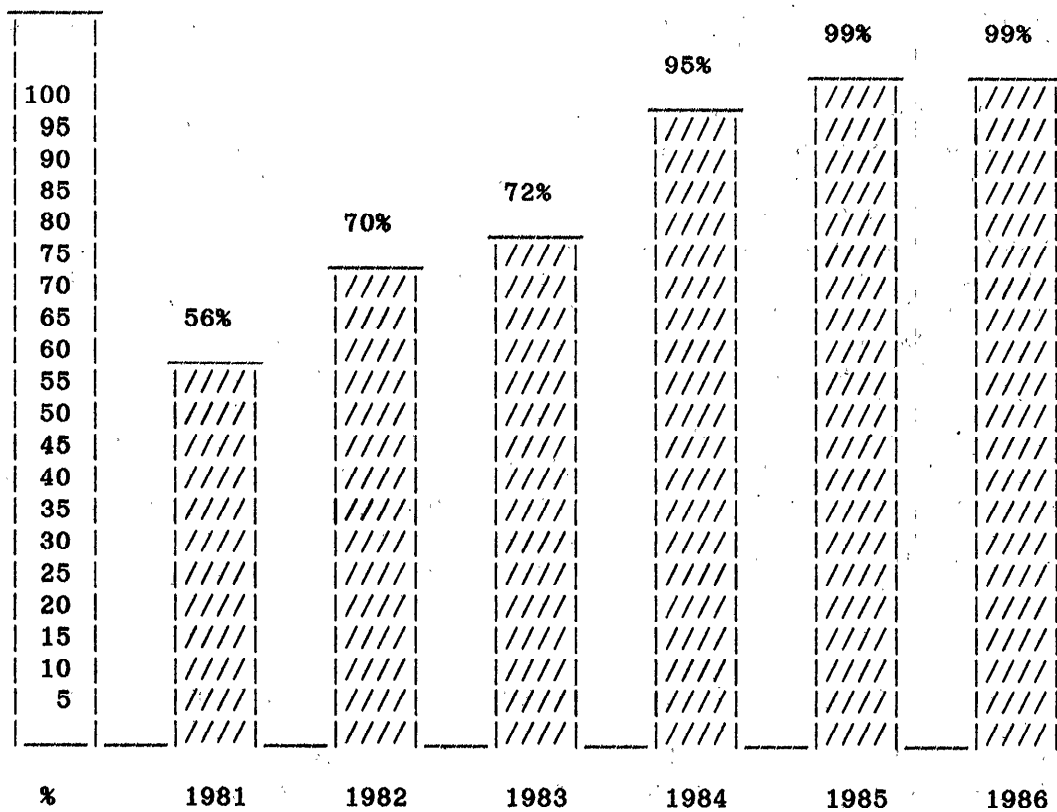
In 1981 the Fisheries Project initiated a voluntary poundage assessment program in Youngs Bay where fishermen voluntarily contribute 5% of their poundage value to the Fisheries Project (Figure 2). Fishermen participation has steadily increased, but that does not necessarily mean an increase in dollars to the Project (Figure 3). With high fishermen participation and a low harvest level, the assessment value can be low, as indicated in Figure 3 for 1983. However, low harvest levels may create an increased value for the fish. In 1985 and 1986 the same level of fishermen participation was realized in the assessment program. The 1986 harvest level exceeded that of 1985 by over 4,000 fish (Figure 4); however, the poundage was less (Figure 5) reflecting a slight reduction in assessment funds (Figure 6). This also reflects an average coho size difference from 1985 to 1986. The 1985 average size was about 9.2 pounds/fish, whereas in 1986 the average size was about 7.4 pounds/fish.

Natural Outmigration of Smolts

After the retaining screens at the two coho rearing ponds were removed, seining activity began each day at a point approximately two miles below the release site. At the seining point the fish are about to enter a tide gate into the tidal influence of Youngs Bay. On the same day approximately five hours after the retaining screens were removed, no fish were collected at the site. On the second day, 29 hours after release, fish were collected in the seine. Coded-wire tag recoveries revealed fish from both ponds at the collection site.

The same procedure was used for the fall chinook release from the South Fork Klaskanine rearing and release site. The seining site is about 4.5 miles below the release site and is about 1/2 mile above the tidal influence of Youngs Bay. Again, on the same day no chinook were collected during seining efforts. On the second day, 25 hours after release, fall chinook smolts were collected and verified that they were CEDC released by coded-wire tag recoveries from the seining sample.

In past years, the fall chinook migration has not been this rapid. The fish were nearly the same size each year, but in 1986 the major condition that was different was the stream flow. Flow during release in 1986 was over 15,000 gpm and was subsequent to a period of rainy weather. Flow during the 1984 and 1985 releases was below 8,000 gpm, and migration time to the seining site took about six days each year. For more rapid migration it appears that releases during elevated stream flows should occur. Once the fish are in the tidal estuarine environment of Youngs Bay, it is not known how long they stay. The subsequent survival of adults will be correlated to the yearly outmigration behavior.



**Figure 2. Youngs Bay Commercial Gillnet
Voluntary Assessment Participation**

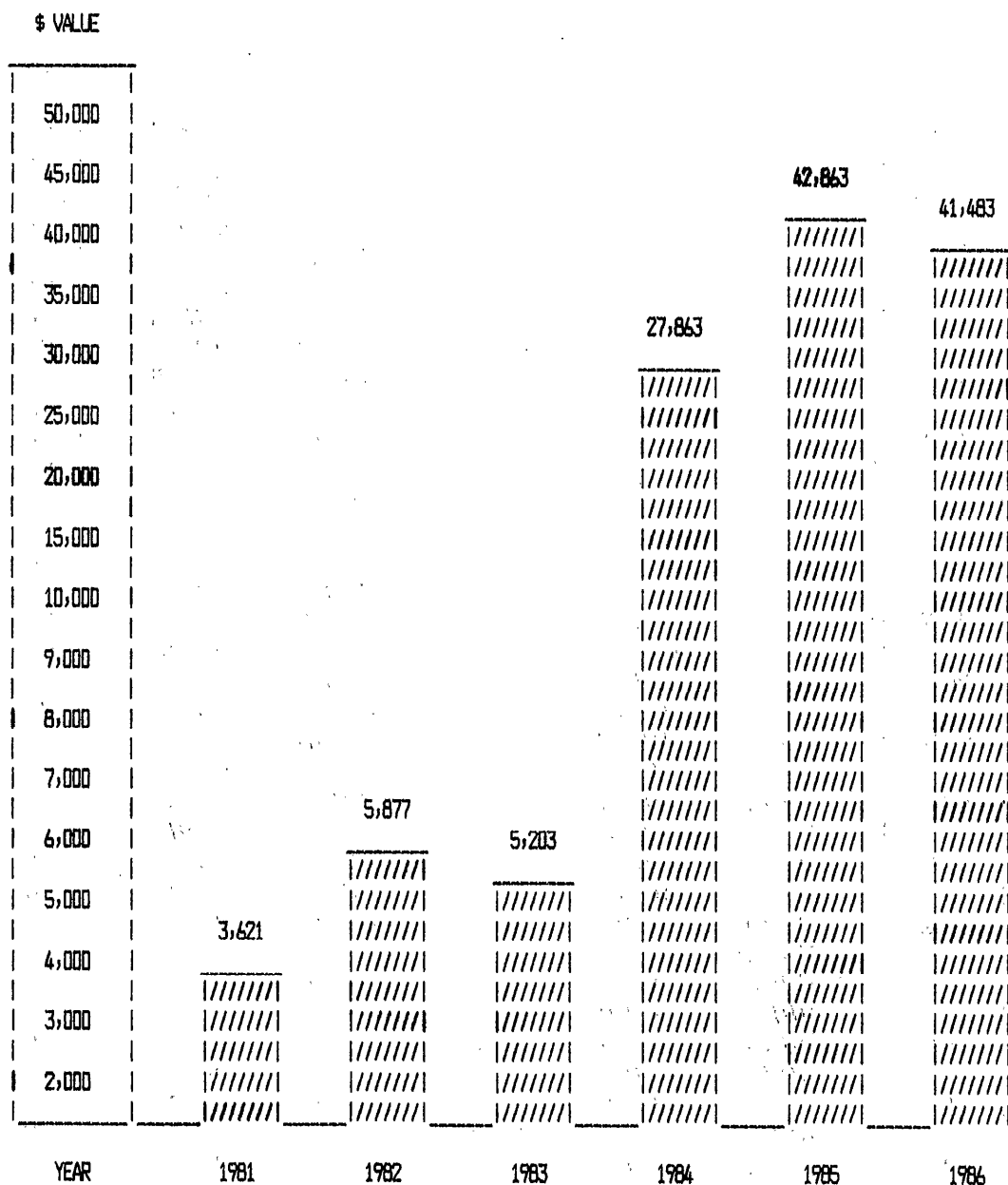


Figure 3. Youngs Bay Voluntary Poundage Assessment Contributions; 1981 - 1986

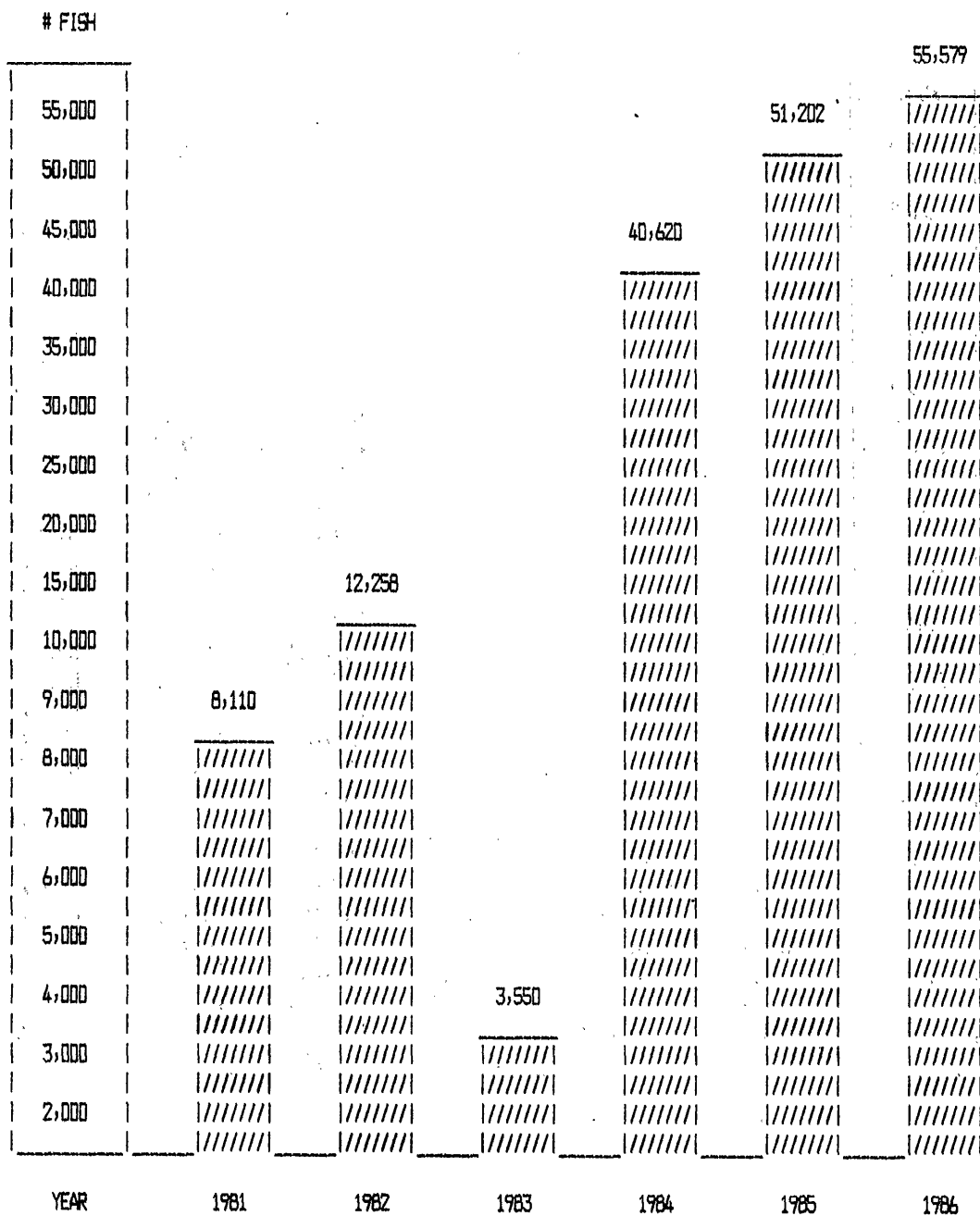


Figure 4. Youngs Bay Coho Harvest (Numbers); 1981 - 1986

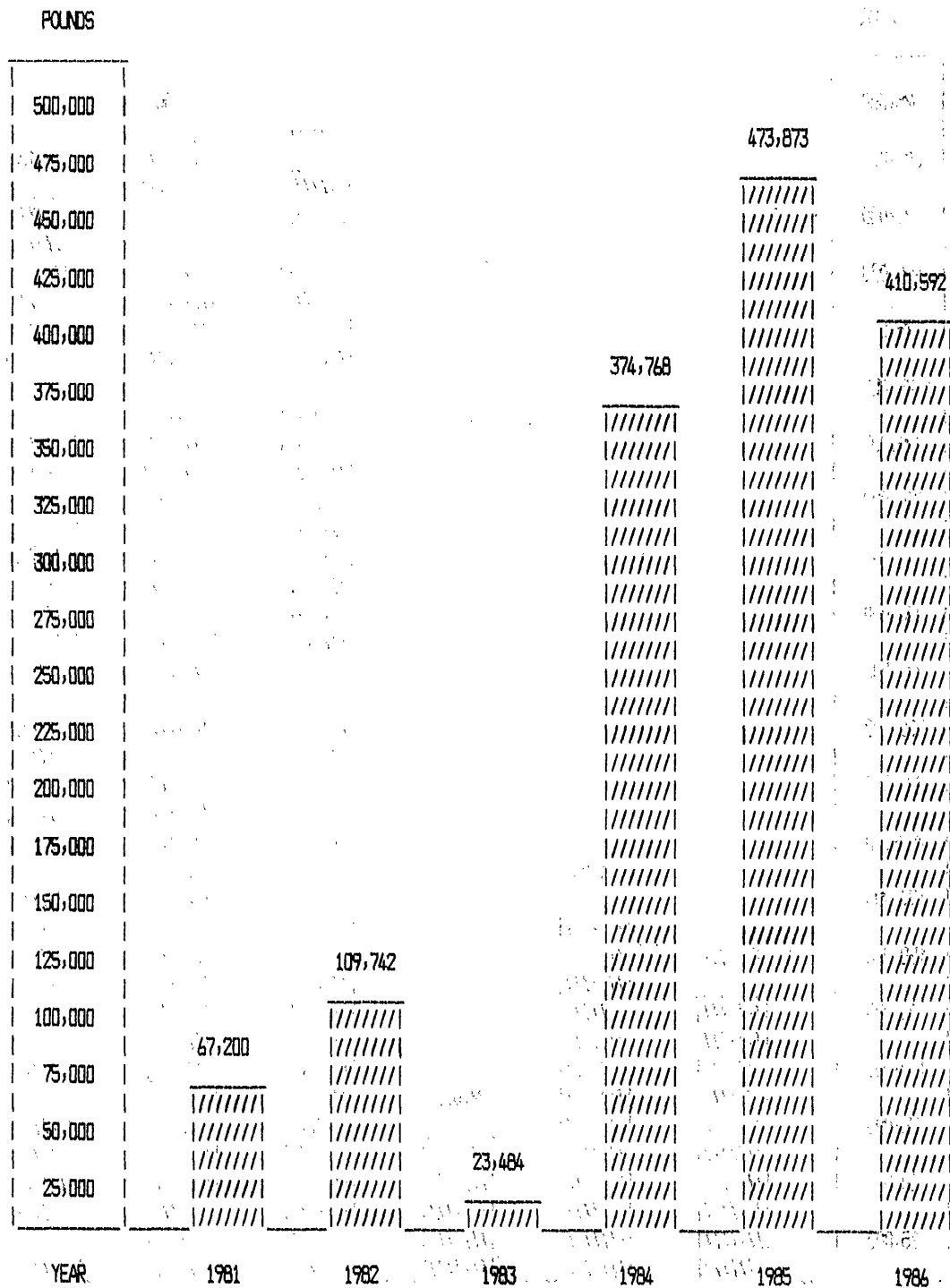


Figure 5. Youngs Bay Coho Harvest (Pounds); 1981 - 1986

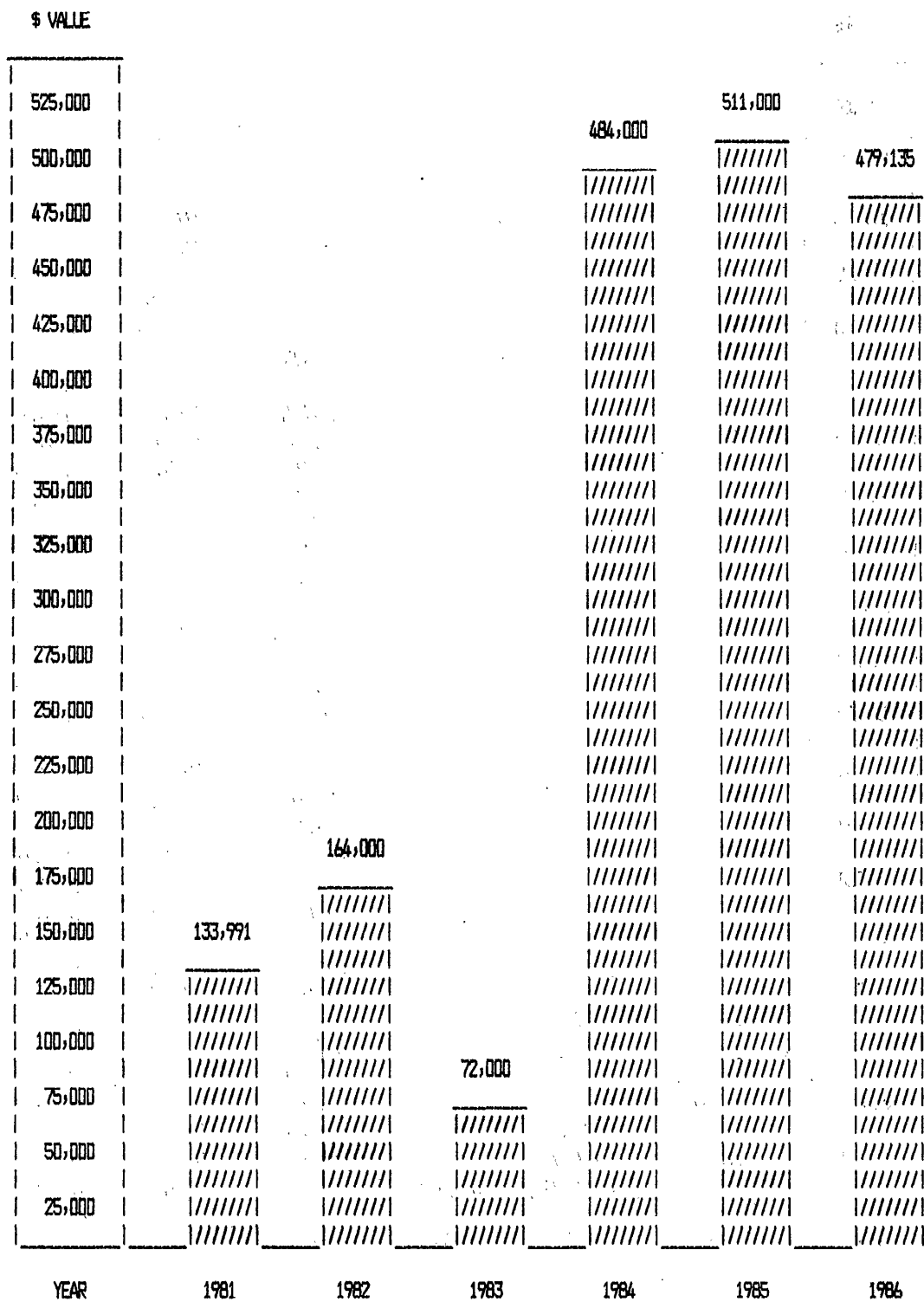


Figure 6. Youngs Bay Catch Value; 1981 - 1986

Cumulative Production of Quality Salmon

The 1986 production levels are shown in Table 2. Production levels vary only slightly from year to year and do not increase, due to the facilities being at or near capacity.

The actual production levels are not so important if subsequent adult survival is not realized. In 1984 the Fisheries Project initiated a project to hopefully increase adult survival of coho. Size at release was compared between the two coho ponds. In 1984 one pond of coho was released at an average smolt size of 9.5 fish/pound, and the other at 16.3 fish/pound. The 1985 harvest of adults showed an adult harvest and survival of the larger smolts by almost ten times that of the smaller smolts, Hickerson and Hill (personal communication, 1985). In 1985 the release of variable sized smolts was again accomplished. One pond was released at 13.4 fish/pound and the other at 16.3 fish/pound. Preliminary harvest and survival figures from the 1986 Youngs Bay gillnet fishery indicate the larger smolts survived at a rate of over 2 1/2 times that of the smaller smolts. With equal numbers of coded-wire tags in each group, there were 63 tags collected from the larger smolt release and only 24 from the smaller smolt release. In 1986 smolts were released from each pond at 12.5 fish/pound. The jack returns to the hatchery give preliminary indications of approximately equal survival rates, which would be expected. Optimal release size will eventually be correlated to adult survival and the cost/benefit ratio.

Fall chinook annual production has been fairly constant at about the 3 million smolt level. In addition to the lower Columbia 'tule' fall chinook being reared and released, a Rogue River fall chinook stock was introduced in 1983. Since then between 12,000 and 250,000 smolts have been released annually (Table 2). The initial adult returns of this stock have been an encouragement for continual future releases. The return from the first release was about 3%; about 100 times the return rate of the 'tules' (Table 4). Also, the quality at harvest reflects a poundage value to the gillnet fishermen of about \$1.50/pound. This can be compared to a \$.40/pound 'tule' chinook. The average price per pound paid to fishermen for chinook in the Youngs Bay gillnet fishery in 1982 was about \$.66/pound, and in 1985 the average price had risen to about \$.89/pound (Table 8). The gradual increase of the higher quality Rogue chinook in the harvest may account for some of the value increase. Preliminary intentions are to continue Rogue stock releases and gradually increase production levels.

The CEDC Fisheries Project modified the operating costs of a hatchery as presented by Harry Senn et al., (personal communication, 1984), to demonstrate how time is utilized within the Project. CEDC's personnel labor breakdown for the smolt production efforts in 1986 are outlined in Table 10. The categories are generalized into similar type activities. Not included as a category is research and development, of which minimal time is expended. Future expectations are for research and development to be expanded and more time allocated. The

Table 8. Youngs Bay Catch Direct Poundage Value
1981 - 1986

Year	chindok			coho			chum		
	Number	Pounds	Value	Number	Pounds	Value	Number	Pounds	Value
1981	4,690	113,300	\$65,414	8,110	67,200	\$67,195	280	2,400	\$1,382
1982	5,129	101,772	\$67,000	12,258	109,742	\$95,000	264	3,237	\$2,000
1983	3,553	66,002	\$48,000	3,550	23,484	\$24,000	5	60	—
1984	3,696	74,179	\$62,000	40,620	374,768	\$421,000	177	2,212	\$1,000
1985	3,466	64,393	\$57,000	51,202	473,873	\$454,000	19	209	\$100
1986	5,455	95,683	\$74,900	55,579	410,592	\$404,235	5	50	—

Table 9. Project Quarterly Time Summary, 1986

CATEGORIES	JAN-MAR		APR-JUNE		JULY-SEPT		OCT-DEC		TOTAL	
	Hour	%	Hour	%	Hour	%	Hour	%	Hour	%
Travel	235.25	10.79%	213.50	10.24%	257.25	13.47%	245.50	11.72%	951.50	11.51%
Pond Maintenance	148.00	6.79%	133.00	6.38%	102.00	5.34%	91.00	4.34%	474.00	5.73%
Ground/Bldg. Maintenance	88.00	4.04%	169.00	8.10%	161.00	8.43%	117.25	5.60%	535.25	6.47%
Feeding	377.50	17.31%	312.50	14.99%	33.00	1.73%	57.00	2.72%	780.00	9.43%
Feed Preparation	49.00	2.25%	17.50	.84%	.50	.03%	3.50	.17%	70.50	.85%
Data Collection	50.50	2.32%	36.00	1.73%	11.50	.60%	59.00	2.82%	157.00	1.90%
Early Rearing	221.50	10.16%	35.50	1.70%	36.50	1.91%	460.00	21.96%	753.50	9.11%
Contract Obligations	0.00	0.00%	0.00	0.00%	0.00	0.00%	2.00	.10%	2.00	.02%
Stream Surveys	0.00	0.00%	1.00	.05%	89.00	4.66%	57.00	2.72%	147.00	1.78%
Sampling	0.00	0.00%	6.00	.29%	131.50	6.89%	34.50	1.65%	172.00	2.08%
Coded-wire tagging	71.50	3.28%	135.00	6.47%	8.50	.45%	73.00	3.48%	288.00	3.48%
Hatchery Assistance	1.00	.05%	4.00	.19%	3.00	.16%	9.50	.45%	17.50	.21%
Construction	103.50	4.75%	173.25	8.31%	321.50	16.84%	77.00	3.68%	675.25	8.17%
Water Control	24.00	1.10%	1.00	.05%	14.00	.73%	43.50	2.08%	82.50	1.00%
Research/Development	8.50	.39%	12.00	.58%	4.00	.21%	4.00	.19%	28.50	.34%
Public Relations	55.00	2.52%	17.00	.82%	92.50	4.84%	28.50	1.36%	193.00	2.33%
Conferences/Meetings	40.50	1.86%	65.00	3.12%	48.00	2.51%	70.50	3.37%	224.00	2.71%
Administrative	202.00	9.26%	201.00	9.64%	230.00	12.05%	164.00	7.83%	797.00	9.64%
Reports	112.00	5.14%	45.50	2.18%	30.50	1.60%	15.50	.74%	203.50	2.46%
Clerical	307.00	14.08%	339.00	16.26%	226.50	11.86%	214.50	10.24%	1,087.00	13.14%
Bookkeeping	80.50	3.69%	68.75	3.30%	93.50	4.90%	127.50	6.09%	370.25	4.48%
In-Kind Services	5.00	.23%	99.75	4.78%	15.00	.79%	140.50	6.71%	260.25	3.15%
TOTAL	2,180.25	100.00%	2,085.25	100.00%	1,909.25	100.00%	2,094.75	100.00%	8,269.50	100.00%
STAND-BY	129.33	5.93%	87.50	4.20%	7.50	.39%	40.50	1.93%	264.83	3.20%

Table 10. CEDC Fisheries Project Personnel Labor Breakdown) 1986

Category	[A]	[B]	[C]	[D]	[E]
	Travel	Pond Maintenance Gr/Bldg. Maintenance feeding Feed Preparation Data Collection Early Rearing Construction Water Control	Contract Obligations Stream Surveys Sampling Coded-Wire Tagging Hatchery Assistance	Public Relations Cont./Meetings Administrative Reports Clerical Bookkeeping	Stand-by
TOTAL HOURS	951.50	3,528.00	626.50	2,874.75	244.03
% OF TOTAL	11.54%	42.79%	7.61%	34.86%	3.21%

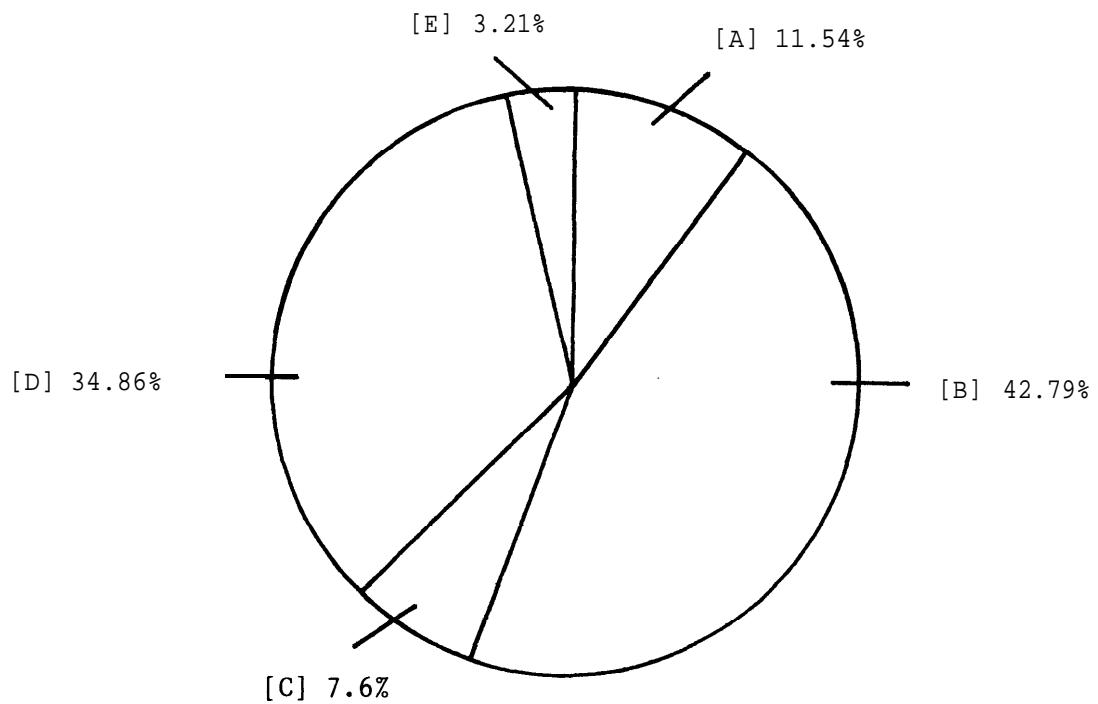
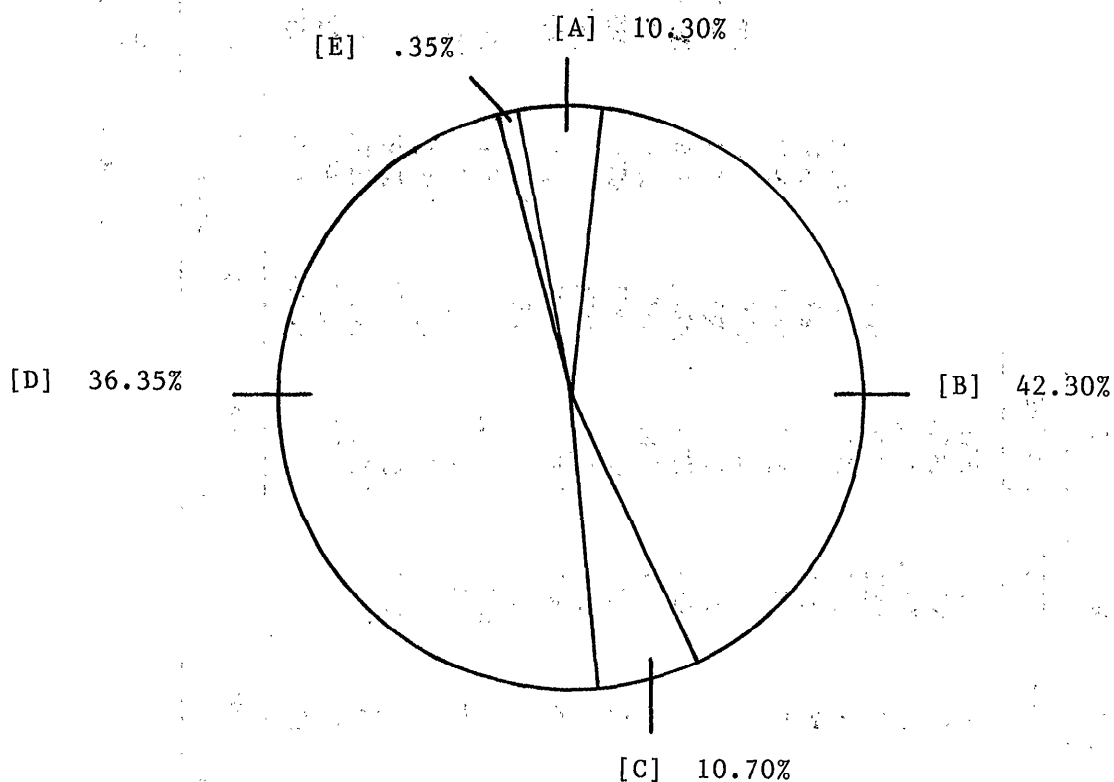


Table 11. Project Quarterly Time Summary, 1985

CATEGORIES	JAN-MAR		APR-JUNE		JULY-SEPT		OCT-DEC		TOTAL	
	Hour	%	Hour	%	Hour	%	Hour	%	Hour	%
Travel	196.50	8.67%	192.50	9.30%	215.50	10.10%	265.00	12.70%	869.50	10.16%
Pond Maintenance	147.00	6.49%	166.50	8.05%	140.50	6.59%	128.50	6.16%	582.50	6.81%
Ground/Bldg. Maintenance	87.50	3.86%	118.00	5.70%	188.50	8.84%	146.50	7.02%	540.50	6.32%
Feeding	278.00	12.27%	419.00	20.25%	124.00	5.81%	59.50	2.85%	880.50	10.29%
Feed Preparation	32.50	1.43%	39.50	1.91%	26.50	1.24%	4.00	.19%	102.50	1.20%
Data Collection	48.50	2.14%	99.50	4.81%	88.50	4.15%	74.00	3.55%	310.50	3.63%
Early Rearing	245.00	10.81%	17.50	.85%	5.00	.23%	210.00	10.07%	477.50	5.58%
Contract Obligations	33.00	1.46%	33.00	1.59%	19.00	.89%	6.00	.29%	91.00	1.06%
Stream Surveys	6.00	.26%	1.00	.05%	84.50	3.96%	40.50	1.94%	132.00	1.54%
Sampling	0.00	0.00%	10.00	.48%	208.50	9.77%	48.50	2.32%	267.00	3.12%
Coded-wire tagging	98.00	4.32%	73.00	3.53%	36.00	1.69%	13.50	.65%	220.50	2.58%
Hatchery Assistance	86.00	3.79%	40.00	1.93%	36.00	1.69%	30.00	1.44%	192.00	2.24%
Construction	133.00	5.87%	57.00	2.75%	162.50	7.62%	192.00	9.20%	544.50	6.36%
Water Control	66.00	2.91%	30.00	1.45%	17.50	.82%	18.50	.89%	132.00	1.54%
Research/Development	11.00	.49%	11.50	.56%	13.00	.61%	16.00	.77%	51.50	.60%
Public Relations	37.50	1.65%	33.00	1.59%	84.50	3.96%	33.00	1.58%	188.00	2.20%
Conferences/Meetings	107.00	4.72%	66.50	3.21%	78.50	3.68%	112.00	5.37%	364.00	4.25%
Administrative	95.00	4.19%	158.00	7.63%	171.00	8.02%	167.50	8.03%	591.50	6.91%
Reports	136.50	6.02%	107.00	5.17%	55.00	2.58%	61.50	2.95%	360.00	4.21%
Clerical	320.00	14.12%	281.00	13.58%	225.50	10.57%	210.75	10.10%	1,037.25	12.12%
Bookkeeping	94.75	4.18%	109.50	5.29%	128.00	6.00%	195.50	9.37%	527.75	6.17%
In-Kind Services	7.50	.33%	6.50	.31%	25.00	1.17%	53.50	2.56%	92.50	1.08%
TOTAL	2,266.25	100.00%	2,069.50	100.00%	2,133.00	100.00%	2,086.25	100.00%	8,555.00	100.00%
STAND-BY	0.00	0.00%	0.00	0.00%	0.00	0.00%	29.75	1.43%	29.75	.35%

Table 12. CEDC Fisheries Project Personnel Labor Breakdown, 1985

Category	[A]	[B]	[C]	[D]	[E]
	Travel	Pond Maintenance Gr/Bldg. Maintenance Feeding Feed Preparation Data Collection Early Rearing Construction Water Control	Contract Obligations Stream Surveys Sampling Coded-Wire Tagging Hatchery Assistance	Public Relations Conf./Meetings Administrative Reports Clerical Bookkeeping	Stand-by
TOTAL HOURS	869.50	3,570.50	902.50	3,068.50	29.75
% OF TOTAL	10.30%	42.30%	10.70%	36.35%	.35%



1986 breakdown nearly parallels that of 1985 (Table 12). The major difference is in the standby category. In 1985 this category was not included until October, whereas in 1986 it was in effect the entire year. Standby activities are those that are performed after normal working hours and are necessary for the livelihood of the fish. Standby responsibilities are primarily nighttime emergency duties; not the same as overtime. The purpose of including the standby category is to demonstrate the amount of time spent during the night; usually under adverse weather conditions.

Travel time should also be noted. The CEDC Fisheries Project does not have on-site housing for employees as most hatcheries provide. Each day personnel meet at the office and must travel to and from, and between the rearing sites. It is hopeful that this travel time can eventually be reduced. With the new hatchery building soon to be completed, a field office may be feasible.

Development of Optimum Density Levels

During the summer of 1986 CEDC personnel solicited the assistance of the Clatsop County surveyor to help determine the volume of rearing pond #3 on the South Fork Klaskanine. Pond volume was previously determined by flow rate and filling time to be approximately 750,000 gallons. The results of cross-sectional segments of the pond, as calculated by a professional surveyor, reflected a volume of 800,000 gallons. The pond volumes allowed the preparation of rearing density tables (Table 13, 14).

Coho production was increased in each of the coho rearing ponds in 1986. Pond #1 production was increased from 100,000 smolts in 1985 to 140,000 in 1986, and pond #2 was increased from 200,000 to 263,000. Daily water quality parameters were monitored until release. The release date has been April 1 for many years and follows the outlined volitional release, Hickerson and Hill (personal communication, 1984). April 1 is the release date because minimal stream flows, coupled with the warming of the water create situations that could be disastrous to the total coho smolt production. Survival information indicates that at this rearing site the April 1 release date is not too early, Hickerson and Hill (personal communication, 1985).

The increase in production at pond #2 demonstrated no hardship effects on the fish and reflected sufficient dissolved oxygen levels up to release. However, the production increase at pond #1 created undesirably low dissolved oxygen levels about two weeks prior to the scheduled release date. At release when the pond began to be lowered, the dissolved oxygen dropped to 3 and 4 ppm. The lowering of the pond concentrated the fish, and hence, also lowered the dissolved oxygen level. Before all the fish had left the pond a significant mortality occurred. Approximately 20,000 fish were lost, leaving a total of 120,000 live fish released. Post release survival will be analyzed upon return of adults.

It appears that the production number in pond #1 should be maintained at the 100,000 level, while pond #2 could be increased to 250,000.

Table 13. CEDC Fisheries Project Production Capacities, 1985

REARING SITE & SPECIES	Species and # fish	Rearing Time Period	Approx Size When Received Fish/lb	Approx Size When Released Fish/lb	Approx Pond Capacity Gal.	Ave. Pond Flows G.P.M.	Pond Water Turnover Rate Hours	Optional Flow Avail. G.P.M.	Minimum Flow Recorded G.P.M.	Fish Density When Received Fish/gal	Pond Loading When Received LB/GL/MN	Pond Loading When Released LB/GL/MN
Earthen Pond #1 Coho	100,000	12/1/84 to 4/1/85	24	10	1,000,000	600	27	0	150	.1	6.9	16.6
Earthen Pond #2 Coho	200,000	12/1/84 to 4/1/85	24	16	1,100,000	1,000	18	0	300	.18	8.3	12.5
Earthen Pond #3 Tule chf	3,000,000	3/12/85 to 6/1/85	350	80	750,000	5,000	2.5	3,000	NA	4	1.7	7.5
Concrete Raceway Inside Pond #3 Rogue chf	83,000	6/9/85 to 8/1/85	73	10	40,000	3,000	.25	3,000	NA	2	.37	2.6
Earthen Pond #4 coho-WT	17,936	6/1/85 to 12/31/85	122	14	60,000	250/300	4/3.3	0	NA	.3	.60	5.1

Table 14. CEDC Fisheries Project Production Capacities, 1986

REARING SITE & SPECIES	Species and # fish	Rearing Time Period	Approx Size When Received Fish/lb	Approx Size When Released Fish/lb	Approx Pond Capacity Gal.	Ave. Pond Flows G.P.M.	Pond Water Turnover Rate Hours	Optional Flow Avail. G.P.M.	Minimum Flow Recorded G.P.M.	Fish Density When Received Fish/gal	Pond Loading When Received LB/GL/MN	Pond Loading When Released LB/GL/MN
Earthen Pond #1 Coho	140,000	12/1/85 to 4/1/86	25	12.5	1,000,000	600	27	0	150	.14	9.3	18.7
Earthen Pond #2 Coho	263,000	12/1/85 to 4/1/86	25	12.5	1,100,000	1,000	18	0	300	.24	10.5	21
Earthen Pond #3 Tule chf	3,000,000	3/12/86 to 5/15/86	700	75	750,000	5,000	2.5	3,000	NA	4	1.4	13.3
Concrete Raceway Inside Pond #3 Rogue chf	250,000	3/4/86 to 7/20/86	1,100	35	40,000	3,000	.25	3,000	NA	6.3	.08	2.4
Earthen Pond #4 coho-WT												

The lesser flow and subsequent higher turnover rate in pond #1 restricts it to a lower production level than that of pond #2. Without supplemental oxygenation or other means of increasing dissolved oxygen levels, production levels will not exceed 100,000 and 250,000 in ponds #1 and #2 respectively.

The large pond area allows for a less dense rearing situation as may be utilized in a conventional hatchery. As reflected in the density tables, even with low flows through the large pond the pounds of fish/gallon/minute can be quite large as compared to values of 6 to 10 lbs/gal/min as may be maintained in more conventional hatchery situations. Even though large poundages do occur at those facilities, a rule of thumb is to not exceed 8 lbs/gal/min inflow (personal contact, ODFW employee). A production increase in pond #2 from 200,000 to 250,000 would reflect an increase in lbs/gal/min from 12.5 to 21.

Augmentation of a Unique Known Stock Fishery

The CEDC Fisheries Project rearing and release sites are on tributaries of Youngs Bay, Hickerson and Hill (personal communication, 1984). In conjunction with the Oregon Department of Fish and Wildlife's Klaskanine hatchery and CEDC's ponds, enough fish are produced to justify an extensive terminal fishery in Youngs Bay. The fishery allows for the extensive harvest of chinook and coho salmon. This terminal fishery typically has a harvest season of about three months, beginning in mid August and ending in mid November. The season is uninterrupted and runs 24 hours a day.

In this terminal fishery the fish are predominately hatchery fish and escapement is generally adequate for hatchery production. However, surplus eggs from hatcheries on the mainstem Columbia are available because harvest opportunities of returning adults are restricted to protect endangered stocks and species. The fish returning to, and harvested in Youngs Bay are not mixed with the mainstem endangered stocks, and hence, the opportunity for harvest. When leaving the Columbia to enter Youngs Bay the fish separate themselves from the mixed stocks of the Columbia.

A typical harvest level of fish returning to Youngs Bay is about 85%. About 15% of the fish escape the intense fishery and are available in the streams for sport harvest, natural reproduction, and hatchery production. In 1986 the harvest rate was about 74%. Approximately 55,000 coho were harvested, and 20,000 returned to ODFW's Klaskanine hatchery. With the exceptionally large return and the opportunity for many fishermen to fish in the mainstem Columbia, the effort in Youngs Bay was not as extensive as in past years.

Not only does the Youngs Bay enhancement effort provide fish for local fishermen, but it also has an impact on the various fisheries throughout the ocean migration (Tables 3, 4, & 5). Fish released in Youngs Bay are harvested from British Columbia to California.

Adult salmon returning to Youngs Bay that are not harvested, return to various streams of the Youngs Bay drainage. If the fish do not enter a hatchery facility they remain in the various streams to fulfill their life-cycle requirements of reproduction. Surveys were made on the streams of the Youngs Bay drainage to assess the extent of natural spawning (Table 7). Coded-wire tag recoveries during the stream surveys indicate a minor incidence of straying. Of the 104 fish observed on the Lewis and Clark River, all were tules with two having coded-wire tags. Both coded-wire tag recoveries were from fish released at CEDC's South Fork Klaskanine pond. Expansion of this number to include the unmarked fish results in a total of 47 fish. Of the 104 fish, almost half were from the South Fork Klaskanine release. Of all the streams surveyed, only the Lewis and Clark and South Fork Klaskanine had coded-wire tagged fish in them. In the South Fork Klaskanine, all coded-wire tagged fish recovered were released from there.

An explanation for the straying in the Lewis and Clark is that it is the first stream the fish encounter when entering Youngs Bay. As the fish move up the Bay they are harvested before they enter the other streams, hence, the fewer numbers of fish in those other streams.

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